A Review of Irrigation using Treated Pulp & Paper Mill Effluent

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Abstract:

The effluent generated is normally considered to be highly polluting. But, for the mills using waste paper as a raw material the treated paper mill effluent is successfully being used for irrigation purpose, and in many cases even a gain in crop yield has been reported. This paper is an initiative towards removal of myths in this area.

Introduction:

Paper mills have been considered a major source of pollution since long. The most sufferers are the waste paper based units, which are basically recyclers, but like to be called by the name “Paper Mill”. These mills use lesser amounts of chemicals, lesser harmful ones-, create no harmful effect on environment, and even to some extent, helpful to environment. While CREP (Corporate Responsibility on Environmental Protection) emphasizes on reducing pollution levels and mark it as top priority item, it is also required that we must have a systematic approach and also indicate the benefits of treated effluent for irrigation purpose. This work is basically to present relevant information and to let readers evaluate the advantages of such units as well as of using treated effluent for irrigation.

The Process:

The papermaking in waste paper based paper mill is basically a recycling process as stated above. The process involves collection and storage of waste paper, sorting to be used as per different grades of paper produced, and slushing in a pulper, alongwith water to prepate a fiberous suspension called pulp. This pulp is passed through different equipments for further cleaning and fiber development for strength increase. Having done that, some non hazardous chemicals are added to it which are needed for paper properties, and papermaking, and then paper is made on a paper machine. During the processing, solid waste generated might contain some minor amounts of plastic waste, staple pins, stones etc. The effluent generated contains minor amounts of fibre particles, which are biodegradable in nature and fillers used in preparation of paper from virgin fiber.

In case better brightness is required, mild bleaching is done to pulp, with the help of hypo. It is interesting to note that the quantity of bleaching chemicals needed for bleaching of waste paper pulp is nearly oine tenth of the same required for a virgin fiber based pulp. That is a recycler is generating at least 90% less pollution than its counterpart.

Chemicals:

Before proceeding further, we must have a look on the chemicals used in processing of waste paper for papermaking, and other applications where thase are used as crude or with minor treatment.

Chemical	**Other Application**
Rosin	Known as *Gond*, it is used for several sweets preparation, namkeen preparation etc.
Alum	Known as *Fitkari*, it is used as aftershave by most barbers.
Talk	Known as *Talcum Powder* it is used as a cosmetic on face.
Calcium Carbonate	This is a major constituent of most toothpastes, most medicines for bones, teeth strength etc.
Starch	This is used for imparting stiffness to cotton clothes as well as a major constituent for preparation of vegetable soups used as apitizer before food.

As indicated above, all the chemicals are non-hazardous, and the only fear that appears in the mind of a common man is just due to the word “Chemical”.

Effluent Treatment:

Though, the inputs are non-hazardous, yet, to maintain better environment, the generated effluent is treated in effluent treatment plant. Here, solids, which can be removed easily by sedimentation are removed in clarifiers, the underflow –the sludge- is used for preparation of low cost items such as egg treys, grey board etc. Alternatively, it can be used as an excellent landfill material in low-lying areas. The clarified water is then send to aeration tanks, where, air is added to effluent, and with the help of air and bacteria, biosolids floc together and appear in suspended form. To enhance this reaction, urea and DAP are added in the aeration tanks. This effluent is then send to secondary clarifier, where these solids settle, and sludge is obtained in underflow.

This secondary sludge is an excellent manure for agricultural purposes. Research has shown that this sludge contains major nutrients e.g. nitrogen, phosphorus etc, and in several places, it has been found that the use of this sludge as well as treated mill effluent

for irrigation purpose has resulted in an increase of over 20% in crop production. Some major advantages of using treated mill effluent for irrigation purpose are listed below—

1. Improvement in Soil Productivity:

It has been found that the soil productivity improves by using treated paper mill effluent for irrigation. This has been indicated in many of the research papers, where, an increment of even 20-30% in crop production has been reported. Some of the figures are-

	Location	**Crop**	**Fresh Water Irrigation**	**Treated Effluent Irrigation (50%)**
(a).	Shamli (U.P.)	Paddy, (q/ha)	44.1	50.4
(b)	Shamli (U.P.)	Maize, (q/ha)	25.8	29.8
(c)	Shamli (U.P.)	Wheat, (q/ha)	22.9	23.8
(d)	Shamli (U.P.)	Mustard (q/ha)	10.0	11.5
(e)	Paithon (Aurangabad)	Wheat (q/ha)	29.6	31.5
(f)	Paithan (Aurangabad)	Mustard (q/ha)	4.4	4.6
(g)	SPB, Erode	Sugar Cane, t/ha	33-50	40-60

- (Reference 1)

The National Bank for Agricultural and Rural Development (NABARD), based on expert survey that the soil as well as the ground water were not affected, came foreward to refinance the loans given earlier by Bank of India for lift irrigation schemes at Seshasayee Paper & Boards Ltd., (SPB), Erode-648007.

2. Improved Crop Properties:

It has been found that the crop obtained this way is better yielding, e.g. not only the per hectare sugarcane production is increased, but also, the recovery of sugar is improved with sugarcane grew with treated mill effluent. This is evident from the following figures-

Effect of Treated Effluent on Juice Quality of Sugar Cane at Shamli, (U.P.)

	Quality Characteristics	**Fresh Water Irrigation**	**Treated Effluent Irrigation (50%)**
(a)	Brix, %	20.32	19.80
(b)	Pol, %	17.42	17
(c)	Purity, %	85.73	86.62
(d)	CCS, %	11.33	11.24

(Reference 1)

3. Improved Farmer Economics:

As no or very little fertilizers are required, the use of treated mill effluent reduces the financial burden on farmers, and thus improves their profitability. Furthermore, as the farmers are less dependent on groundwater if irrigation is met by treated mill effluent, it reduced their electricity bills, less fuel consumption for running the pumpsets etc.

4. Reduced Electricity Consumption:

It is interesting to note that the pump sets used by most farmers are less energy efficient. This is because of using rewound motors, using off grade pumps, unmetered supply for most of the farmers etc. As the effluent discharged by the mills from a level above ground level, no pump set is required by the farmers, in the nearby areas to paper mills. This way, reduction of farmers electricity bill is achieved. Furthermore, electricity given to farmers is highly subsidized which is evident from the following figures-

Sectorwise Average Realization of Power

Category	**Rs. Per unit**
Agriculture	0.21
Domestic	1.52
Industry	3.54
Commercial	4.30
Average	2.10 (Reference 2)

This indicates clearly, if the farmers can use treated mill effluent for irrigation, their electricity requirement and hence subsidy on this saved electricity will be reduced, which is in national benefit.

Published Results:

A lot of work has already been done in this regard, a brief summery of which is given hereunder-

Study Title	**By**	**Source**	**Brief Results**
Waste Paper Sludge to Agriculture Land	Bridgewater Paper Company UK	U K environmental Technologies & Services Report	Paper mill sludge is rich in Nitrogen, Phosphorus, Potassium etc.
Utilization of …Crop Production	Dr. N P Singh, Jt. Director, IARPMA, New Delhi	Paper India 3(4):14 (August2000)	At different places, it was observed that when irrigated with mill effluent also, the growth of paddy, maize, wheat,

			mustard increased by 20%
Irrigation with treated …Experience	Dr. N. Gopalratnam, SPB Ltd., Erode	Paper India 2(6):8-9 (Dec.99)	Increase in sugar cane yield by 20% when irrigated with treated paper mill effluent.
Composting of Effluent Treatment Sludge	Central Pulp & Paper Research Institute	IPPTA convention Issue, 1993-94, Page 141-149	Sludge contains microneutrients N,P,K of the same quantity as in case of sheep dung & cowdung.
Pollution Abatement…Bio methanation Process	S. Panwar Central Pulp & Paper Research Institute	Training Program, Ahmedabad, April 12-16, 2003	The effluent generated during the processing of waste paper contain easily biodegradable organic matter.
Guidelines for the Utilization of Pulp & Paper Mill Biosolids on Agricultural Land	Water & Earth Science Associates Ltd.	Final Report File No. B1333 Feb. 2002	Use of pulp & paper mill biosolids results in improved soil characteristics and is very useful for land.

Results Obtained:

The effluent treatment plant installed in a typical consists of a stabilization tank, a primary clarifier, aeration tanks with two aerators, and finally a secondary clarifier. Typical properties of the effluent treated are as under-

PH	7.1
Suspended Solids	68 ppm
BOD (5 Days, 20 C)	26 ppm
COD (Reflux Method)	78 ppm
Oil & Grease	0.6 ppm

All of these properties are within local pollution control norms, and the clean treated water leaves factory premises to a nearby rain nallahs, or other similar drainage facility. Soon after a plant came into operation, the farmers come to know that the effluent coming out of factory is very useful to them. Within a short span of time they find that the sugar cane production in the fields was increasing and the height of sugarcane increased by approx. 20%. Having known that they become eager to use treated mill effluent, and sometimes in the weather of summer, when the fresh water irrigation is very difficult, due to acute shortage of grid power, they started coming to factory demanding more effluent to be discharged to cater their need.

Conclusion:

It is evident that the recycled fiber based paper mill treated effluent is really beneficial to farmers. In some cases it has been found that the farmers prefer to use treated mill effluent for irrigation over the fresh water due to benefits listed above.

References:

1. DR. N P Singh, Paper India, 3(4):14(July-August 2000)
2. In Defence of MSEB, POWER LINE, 3(7):10-13(April 1999)